

Psychological indicators of overtraining in high level judo athletes in pre- and post-competition periods

Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Manuscript Preparation
- E Funds Collection

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Abstract

Background & Study Aim: Given the psychological, physiological and nutritional demands of elite sport judo, it is not surprising that many athletes struggle to optimize training. Overtraining is the result of an imbalance between stress and recovery, as result of short recovery time and psychosocial events. The aim of this study is knowledge about the psychological indicators of overtraining in elite judo athletes during pre- and post-competition periods.

Material & Methods: Forty-eight judo athletes from an elite team took part in this study. They were grouped by age, 24 junior (up to 18 years) and 24 senior (over 18 years). For the assessment of psychological indicators of overtraining the stress and recovery questionnaire RÊSTQ-Sport questionnaire in the last practice before competition and in the first practice after competition. It comprises 76 items organized in 19 general scales.

Results: Only two scales presented significant differences between the pre- and post-competition periods for the entire group (n = 48): the “fatigue” scale of the general stress dimension and “success” in the general recovery dimension. The comparison of the age groups in the pre-competition period resulted in significant differences in 9 out of the 19 scales and in the four dimensions. The male athletes’ profile was more positive than the junior athletes’ profile. In the post-competition period, significant differences were observed in 3 out of the 19 scales. A similar result pattern was observed; the senior athletes had a more positive profile. The longer sports practice time, and consequently more competition experience at this level, may have contributed to the differences between the age groups. Such a fact may be observed in the perception of pre- and post-competition performance. The junior athletes felt less prepared in the evaluated aspects than the senior athletes, especially in “technique” (p ≤ 0.002). The low performance values in competition indicate that the group did not achieve the expected result.

Conclusions: Pre- and post-competition psychological indicators of overtraining may behave differently as a function of judo athletes’ age. Older athletes tend to have a more positive profile than younger ones. The comparison between the psychological variables shows a greater difference in scores for age. The expectations in relation to the competition affected young athletes significantly.

Keywords: Athletic Performance • Martial Arts • Recovery • Psychological tests • Stress

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Judo – a Japanese martial art in which opponents use balance and body weight, with minimal physical effort, to throw each other or hold each other in a lock [26].

Martial arts – activities in which participants learn self-defense mainly through the use of hand-to-hand combat. Any of various systems of combat and self-defense developed especially in Japan and Korea and now usually practiced as a sport [26].

Recovery – a partial or complete return to the normal or proper physiologic activity of an organ or part following disease or trauma. The process of returning to health after being ill or injured [26].

Sport psychology – is an interdisciplinary science that draws on knowledge from many related fields including biomechanics, physiology, kinesiology and psychology. It involves the study of how psychological factors affect performance and how participation in sport and exercise affect psychological and physical factors [27].

Stress – a factor or combination of factors in a person's life that make him or her feel tired and anxious. A condition in which an outside influence such as overwork or a mental or emotional state such as anxiety changes the working of the body and can affect the hormone balance [26].

INTRODUCTION

As all elite sports develop, athletes are under increasing pressure to improve their performance. Intense training and competition periods place athletes under increased stress [1,2]. In these conditions, some athletes can exceed their physical and psychological capacities to deal with both the demands of intense and frequent training sessions and regular competition [3]. As a result of the difficulty in ensuring an adequate recovery, evidence shows that many athletes have insufficient recovery intervals [4,5]. Therefore, the increased training commonly used to strengthen the athletes' performance may lead to increased fatigue and reduced performance [6]. These are the characteristic symptoms of the overtraining syndrome. Overtraining can have serious consequences, such as withdrawal from the sport and burnout [6,7].

During the intense training phase, some athletes may perform poorly due to specific psychological and physiological processes [8]. When the intensity and the volume of training exceed the body's recovery and adaptation capacity, it may respond with excessive fatigue [8]. The combination of excess stress loads in training and non-training, combined with insufficient recovery, is called overtraining [6].

From a clinical standpoint, Israel [9] distinguished between a parasympathetic or vagal type overtraining syndrome and a sympathetic type. Parasympathetic overtraining, also known as "modern overtraining", is characterized by increased parasympathetic activity and its signs include fatigue, apathy, altered mood state, poor performance, and altered reproductive and immunological functions. Sympathetic overtraining, or "classical overtraining", is characterized by high sympathetic activity, including hyperexcitability, restlessness, and poor performance [10].

Because it is a syndrome, in the overtraining a host of factors may be present, including nutrient deficiencies, immunosuppression, chronic infection, psychological stress, depression, and hormone imbalance [11]. Athletes that do not allow their bodies to recuperate are at risk of experiencing both psychological and physiological disturbances, present in the overtraining syndrome [6].

Monitoring is required to prevent it from affecting athletes. Shephard and Shek [12] suggest that psychological testing might reveal early symptoms more clearly than many physiological and immunological markers. Kellmann [13] proposes the advantage of

psychometric instruments is that they provide information quickly. Furthermore, psychological assessment is cheaper and the diagnosis is frequently successful.

Aiming to contribute to the analysis and the possible prevention of this condition, this study evaluated the effect of pre- and post-training periods and age on the psychological indicators of overtraining.

MATERIAL AND METHODS

Data Collection

Forty-eight judo athletes from an elite team took part in this study. They were grouped by age, 24 junior (up to 18 years) and 24 senior (over 18 years). These athletes participated in two Brazilian national competitions in 2008.

For the assessment of psychological indicators of overtraining the stress and recovery questionnaire RESTQ-Sport 76 validated for the Portuguese language [14] was used. It comprises 76 items organized in 19 general scales (table 1), 12 of them in a standard way, and 7 others specific to judo. The 19 scales are organized in four broad dimensions (general stress, general recovery, stress in sports, and recovery in sports). They evaluate potentially stressing and relaxing events and their consequences in the last three days/nights as regards the aspects evaluated [15]. The questions are answered by means of an evaluation scale of 7 values, where 0 = never and 6 = always [8].

To the stress and recovery questionnaire were added qualitative questions elaborated by the researchers themselves on the pre-competition result expectations and the post-competition perception of performance.

Procedure

A protocol requesting permission for the research was submitted to the Technical Scientific Office of the chosen sports club. The psychological indicators of overtraining data were collected on the following occasions at the club training facilities:

- after the last practice before competition,
- before the first practice after competition.

The athletes answered the RESQ-Sport 76 in the presence of the researcher, who helped with doubts that the volunteer athletes might have.

The athletes gave their free informed consent of participation and the study was submitted to and

Table 1. Scales of the Recovery-Stress Questionnaire for Athletes [15, p. 6-7]

Scale	Scale Summary
1-General Stress	Subjects with high values describe themselves as being frequently mentally stressed, depressed, unbalanced, and listless.
2-Emotional Stress	Subjects with high values experience frequent irritation, aggression, anxiety, and inhibition.
3-Social Stress	High values match subjects with frequent arguments, fights, irritation concerning others, general upset, and lack of humor.
4-Conflicts / Pressure	High values are reached if in the preceding few days conflicts were unsettled, unpleasant things had to be done, goals could not be reached, and certain thoughts could not be dismissed.
5-Fatigue	Time pressure in job, training, school, and life, being constantly disturbed during important work, overfatigue, and lack of sleep characterize this area of stress.
6-Lack of Energy	This scale matches ineffective work behavior like inability to concentrate and lack of energy and decision making.
7-Physical Complaints	Physical indisposition and physical complaints related to the whole body are characterized by this scale.
8-Success	Success, pleasure at work, and creativity during the past few days are assessed in this area.
9-Social Recovery	High values are shown by athletes who have frequent pleasurable social contacts and change combined with relaxation and amusement.
10-Physical Recovery	Physical recovery, physical well-being, and fitness are characterized in this area.
11-General Well-Being	Besides frequent good moods and high well-being, general relaxation and contentment are also in this scale.
12-Sleep Quality	Enough recovering sleep, and absence of sleeping disorders while falling asleep, and sleeping through the night characterize recovery sleep.
13-Disturbed Breaks	This scale deals with recovery deficits, interrupted recovery, and situational experts that get in the way during periods of rest (e.g., teammates, coaches)
14-Burnout / Emotional Exhaustion	High scores are shown by athletes who feel burnout and want to quit their sport.
15-Fitness / Injury	High scores signal and acute injure or vulnerability to injuries.
16-Fitness / Being in Shape	Athletes with high scores describe themselves as fit, physically efficient and vital.
17-Burnout / Personal Accomplishment	High scores are reached by athletes who feel integrated in their team, communicate well with their teammates and enjoy their sport.
18-Self-Efficacy	This scale is characterized by how convinced the athlete is that he/she has trained well and is optimally prepared.
19-Self Regulation	The use of mental skills for athletes to prepare, push, motivate, and set goals for themselves are assessed by this scale.

approved by the Ethics and Research Committee of the Centro Universitário de Belo Horizonte under protocol number 025/2006.

Statistical Analyses

The sample profile was submitted for descriptive statistical analysis. For comparison of overtraining levels between age groups, t-student test was used for independent samples, adopting a significance level of $p \leq 0.05$.

RESULTS

Only two scales presented significant differences between the pre- and post-competition periods for the entire group ($n = 48$): the “fatigue” scale of the general stress dimension and “success” in the general recovery dimension (Table 2).

The comparison of the age groups (Table 3) in the pre-competition period resulted in significant differences in 9 out of the 19 scales and in the four

Table 2. Pre- and post-competition RESTQ-Sport scores

SCALE	Period	AVG	SD	P
Fatigue	Pre-competition	2.68	1.31	.041
	Post-competition	1.96	1.28	
Success	Pre-competition	3.93	1.22	.050
	Post-competition	3.23	1.41	

Table 3. Comparison pre- and post- competition RESTQ-Sport scores as a function of age

SCALE	Period	Senior		Junior		P ≤ 0.05
		AVG	SD	AVG	SD	
General Stress	Pre-competition	0.75	0.65	1.70*	0.73	.003
	Post-competition	0.56	0.72	1.63*	1.44	.032
Emotional Stress	Pre-competition	1.46	.071	2.35*	1.20	.037
	Post-competition					
Lack of Energy	Pre-competition	0.94	0.48	1.56*	0.87	.041
	Post-competition					
Success	Pre-competition	4.67*	1.22	3.44	0.73	.007
	Post-competition	4.19*	1.34	2.77	0.89	.006
Physical Recovery	Pre-competition	3.96*	1.22	2.96	1.22	.058
	Post-competition					
General Well-Being	Pre-competition	4.79*	0.99	3.52	1.12	.008
	Post-competition	4.79*	1.22	3.67	1.52	.058
Sleep Quality	Pre-competition	3.96	0.96	3.19	1.03	.071
	Post-competition					
Emotional Exhaustion	Pre-competition	0.83	0.89	1.67*	1.10	.054
	Post-competition					
Injury	Pre-competition	2.04	1.59	3.29*	0.76	.022
	Post-competition					
Being in Shape	Pre-competition	4.35*	0.98	3.44	0.93	.029
	Post-competition					
DIMENSIONS						
General Stress	Pre-competition	1.63	0.73	2.32*	0.89	.030
	Post-competition					
General Recovery	Pre-competition	4.42*	0.83	3.37	0.67	.001
	Post-competition					
Sports Stress	Pre-competition	1.65	0.80	2.47*	0.97	.020
	Post-competition					
Sports Recovery	Pre-competition	4.50*	0.74	3.64	0.92	.011
	Post-competition					

Caption: * p < 0.05

dimensions. The male athletes' profile was more positive than the junior athletes' profile.

In the post-competition period, significant differences were observed in 3 out of the 19 scales. A similar result pattern was observed; the senior athletes had a more positive profile. The longer sports practice time, and consequently more competition experience at this level, may have contributed to the differences between the age groups. Such a fact may be observed in the perception of pre- and post-competition performance (Table 4).

The junior athletes felt less prepared in the evaluated aspects than the senior athletes, especially in "technique" ($p \leq 0.002$). The low performance values in competition (Table 5) indicate that the group did not achieve the expected result.

DISCUSSION

An aspect to bear in mind is the athlete's perception of the competition results in relation to the recovery dimensions. Such periods did not occur during the evaluation. Therefore, the recovery in the pre-competition period refers to the recovery scheduled by the coach during practice. In the post-competition period, there was no recovery time, as the athletes were evaluated immediately after the competition.

The "fatigue" scale (which represents the pressure felt in job, training, school, and life, being constantly disturbed during important work, over fatigue, and lack of sleep) had the highest scores in the pre-competition period [16]; however, its mean value was not much higher

(2.68 ± 1.31) in relation to the score amplitude of the instrument (0-6 in a 7-score Likert scale). This result may be explained by the scales used, which provides only estimates of scores. Low scores may represent a predisposition to feel in a certain way or unreadiness to acknowledge a way of feeling. Before competition, the athletes are expected to express confidence and it is common that they express low scores of fatigue [16].

"Success", which represents the pleasure felt at work and creativity [15], had the highest scores in the pre-competition period. The mean value, however, was (3.93 ± 1.22), which was only slightly higher than the mean scores for the instrument.

In the comparison between situations (Table 2), the pre-competition period revealed a lower "fatigue" score. This is a positive factor in athlete training in the pre-competition period [13]. Meeusen et al. [6] recommend reducing the training load before competition to allow full recovery, and, thus, maximum performance.

The "success" scores found in the pre-competition period may indicate that despite the favorable perception before competition, it was actually average. Its lower value after competition may reflect the athletes' perception of their performance as being below expectations (Table 5). These results may be explained by the fact that they participated in the Brazilian national-level competitions, which are classificatory for a major international competition. This may have led to greater tension in the athletes. The differences between ages (Table 3) in both periods do

Table 4. Expectation of competition results (comparison of ages)

Questions (1-5 in a 5-point Likert scale*)	Senior	Junior	P ≤ 0.05
1- What is your expected result in this competition?	4.57 (± 0.65)	4.20 (± 0.68)	.143
2- What is your PHYSICAL condition for this competition?	4.00 (± 0.78)	3.60 (± 0.83)	.194
3- What is your TECHNICAL condition for this competition?	4.21 (± 0.58)	3.53 (± 0.52)	.002**
4- What is your TACTICAL condition for this competition?	4.43 (± 0.75)	4.00 (± 0.92)	.185
5- What is your PSYCHOLOGICAL condition for this competition?	4.43 (± 0.85)	3.87 (± 0.91)	.099

Caption: 1- very bad, 2 – Poor, 3 – fair, 4 – Good, 5- Excellent

** p<0.01

Table 5. Perception of performance in competition (comparison of age)

Questions (1-3 in a 3-point Likert scale*).	Senior	Junior	P ≤ 0.05
1- What is the level of the opponents?	1.93 (± 0.47)	2.00 (± 0.53)	.707
2- How was your performance?	1.64 (± 0.63)	1.67 (± 0.82)	.931
3- How do you see your result in this competition?	1.21 (± 0.42)	1.47 (± 0.64)	.225

Caption: 1- below expectations, 2- as expected, 3- above expectations

not require further attention. Motivational variables viewed here include the need for achievement and the fear of failure. That is a predominant force that directs our behavior toward positive and negative outcomes. These motives are considered as working together to regulate achievement behavior and they are treated as predictors for performance outcomes [17].

Noce et al. [8] observed similar “success” (2.00), “good physical condition” (2.25), lower “emotional exhaustion” (2.25), and higher “self-efficiency” scores for a Brazilian elite female volleyball player in comparison to the values found in this study after a defeat in competition. Regardless of the type of sports practice, either group or individual, success and failure in high performance sports tend to provoke similar behaviors, particularly in major competitions.

In general, judo athletes undergo a body mass loss in the period before competition. Filaire et al [18] reported that 65% of the studied athletes (judo fighters and cyclists) lost over 3 kg during the season as a result of intentionally restricting their diets. In the present study, the athletes reported seven different ways of obtaining sharp weight loss by dehydration, including the use of diuretics and laxatives, increased exercising, and vomiting. Many judo fighters (25%) reported suffering pressure to lose weight from coaches, friends, or self-imposed.

Timpmann et al. [19] observed reduced physical performance in short periods of high exercise intensity in athletes of combat sports after a rapid body mass loss. Judo competitions are normally very intense, because the athletes take part in several fights in the same day due to the way competition is organized.

The results published by Yoshioka et al. [20] suggest that after body mass loss, the psychological stress increased in male judo athletes, in contrast to the female athletes’ response. Kolayis and Sari [21] found that the educational level significantly correlated with the rank of competition and state anxiety in judokas. Junior athletes aim for the highest performance level, and to attain success as senior athletes, some coaches and the athletes themselves think that they must begin to train intensively well before puberty, at levels that are considered exhausting even for adult athletes, based on the assumption that they can resist the physical and psychological pressures inherent to elite sports [1,22]. Table 3 corroborates this correlation, both in the pre- and the post-competition periods. Young athletes (junior) obtained significantly lower scores ($p \leq 0.05$) than older athletes’ (senior).

Social relations such as proximity to family, friends, girlfriend/boyfriend, relation to the coach, and pressures at school may be psychosocial stress factors that contribute to the onset of the overtraining syndrome in young athletes. Another contributing factor is the lack of non-sport related leisure activities, as a result of the long training hours. According to the same authors, many other psychological problems afflict young athletes during overtraining, such as reduced self-confidence and capacity of concentration, high irritability, depression and sadness, and high perceived stress [1,22]. The comparison of athletes of age group (Table 3) shows that social stress affects young athletes as a whole in the pre-competition period ($p=0.05$).

Vardar et al. [23] studied the influence of partial and total deprivation of sleep on the state of anxiety and the anaerobic performance of athletes. They observed heightened anxiety levels after partial and total deprivation of sleep, but no variation in anaerobic performance. Young athletes slept more poorly ($p=0.012$) during the pre-competition period (Table 3). This condition may be explained by the result expectation (Table 4), which was more negative in young athletes. The combined results are strong indicators of pre-competition anxiety.

The “self-regulation” scale refers to the athletes’ evaluation and use of psychological abilities as strategies to improve performance [24]. Coaching before the competition may play a role in mental preparation by defining fight goals and strategies. Studies of judo coaches and athletes evaluated the amount of information that the coaches gave the athletes before competition. The results revealed that a large amount of the information provided by the coaches is often lost. The authors suggest that instructions be provided in a concise and coherent way for the athletes’ better assimilation [25]. Significant positive differences in “self-regulation” (Table 3) were observed only in the post-competition period in older athletes ($p=0.05$).

CONCLUSION

In conclusion, pre- and post-competition psychological indicators of overtraining may behave differently as a function of judo athletes’ age. Older athletes tend to have a more positive profile than younger ones. The comparison between the psychological variables shows a greater difference in scores for age. The expectations in relation to the competition affected young athletes significantly.

CONFLICT OF INTEREST

Author declares that there are no conflict of interests.

REFERENCES

1. Kenttä G, Hassme P, Raglin JS. Training Practices and Overtraining Syndrome in Swedish Age-Group Athletes. *Int J Sports Med* 2001; 22: 460-465
2. Paul M, Khanna N, Sandhu JS. Psycho-motor analysis of athletes under overtraining stress. *Ser J Sports Sci* 2012; 6(3): 95-101
3. Sogabe A, Sasaki T, Kaya M et al. Correlation between heart rate on morning rising and condition of judo players during training camp. *Arch Budo* 2009; 5: 41-45
4. Birrer D, Lienhard D, Williams CA et al. Prevalence of non-functional overreaching and the overtraining syndrome in Swiss elite athletes. *Schw Zeitspormed Sport* 2013; 61(4): 23-29
5. Costa LOP, Samulski DM. Overtraining in High Level Athletes: A Review. *Revista Brasileira Ciência e Movimento* 2005; 13(2): 123-134 [in Portuguese]
6. Meeusen R, Duclos M, Foster C et al. Prevention, diagnosis and treatment of the overtraining syndrome: Joint consensus statement of the European College of Sport Science (ECSS) and the American College of Sports Medicine (ACSM). *Eur J Sports Sci* 2013; 13(1): 1-24
7. Kreher JB, Schwartz JB. Overtraining Syndrome A Practical Guide. *Sports Health* 2012; 4(2): 128-138
8. Noce F, Santos IC, Samulski DM et al. Monitoring levels of stress and overtraining in an elite brazilian female volleyball athlete: case study. *Revista de Psicologia del Deporte* 2008;17(1): 25-41 [in Portuguese]
9. Israel S. Problems of overtraining from an internal medical and performance physiological standpoint. *Med Sport* 1976; 16: 1-12
10. Lehmann M, Foster C, Dickhult HH et al. Autonomic imbalance hypothesis and overtraining syndrome. *Med Sci Sports Exerc* 1998; 30: 1140-1145
11. Dunford M. Sports Nutrition: A Practice Manual for Professionals. 4rd ed. Chicago: American Dietetic Association; 2006: 420-427
12. Shephard R, Shek P. Potential impact of physical activity and sport on the immune system: A brief review. *Brit J Sport Med* 1994; 28: 247-255
13. Kellmann M. Preventing overtraining in athletes in high intensity sports and stress/recovery monitoring. *Scand J Med Sci Spor* 2010; 20(2): 95-102
14. Costa LOP, Samulski DM. Validation Process of the Recovery-Stress Questionnaire for Athletes (RESTQ-Sport). *Revista Brasileira Ciência e Movimento* 2005; 13(1): 79-86 [in Portuguese]
15. Kellmann M, Kallus KW. The Recovery-Stress Questionnaire for Athletes: User Manual. Champaign, IL: Human Kinetics; 2001
16. Johnston RD, Gibson NV, Twist C et al. Physiological responses to an intensified period of rugby league competition. *J Strength Cond Res* 2013; 27(3): 643-654
17. Korobeynikov G, Mazmanian K, Korobeynikova L et al. Psychophysiological states and Motivation in Elite Judokas. *Arch Budo* 2010; 6(3): 129-136
18. Filaire E, Rouveix M, Pannafieux C et al. Eating attitudes, perfectionism and body-esteem of elite male judoists and cyclists. *J Sports Sci Med* 2007; 7: 50-57
19. Timpmann S, Ööpik V, Pääsuke M et al. Acute effects of self-selected regimen of rapid body mass loss in combat sport athletes. *J Sports Sci Med* 2007; 7: 210-217
20. Yoshioka Y, Umeda T, Nakaji S et al. Gender differences in the psychological response to weight reduction in judoists. *Int J Sport Nutr Exerc Metab* 2006; 16: 187-198
21. Kolayis H, Sari I. Anxiety, self-esteem and competition ranking of judokas. *Arch Budo* 2011; 7: 11-15
22. Malisoux L, Frisch A, Urhausen A et al. Monitoring of sport participation and injury risk in young athletes. *J Sci Med Sport* 2013; 16(6): 504-508
23. Vardar SA, Öztürk L, Kurt C et al. Sleep deprivation induced anxiety and anaerobic performance. *J Sports Sci Med* 2007; 6(4): 532-537
24. Davis IV H, Orzeck T, Keelan P. Psychometric item evaluations of the Recovery-Stress Questionnaire for athletes. *Psychology of Sport and Exercise* 2007; 8: 917-938
25. Mesquita I, Rosado A, Janeiro N et al. Athlete's retention of a coach's instruction before a judo competition. *J Sports Sci Med* 2008; 7(3): 402-407
26. Dictionary of Sport And Exercise Science. London: A. & C. Black; 2006
27. Weinberg RS, Gould D. Foundations of Sport and Exercise Psychology. Champaign, IL: Human Kinetics; 2010

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